

August 26, 2003

Mr. Roy A. Anderson  
President & Chief Nuclear Officer  
PSEG Nuclear, LLC - X04  
Post Office Box 236  
Hancocks Bridge, NJ 08038

SUBJECT: HOPE CREEK GENERATING STATION - EVALUATION OF RELIEF REQUEST  
HC-RR-B08 (TAC NO. MB7839)

Dear Mr. Anderson:

By letter dated February 20, 2003, as supplemented by letter dated May 1, 2003, PSEG Nuclear, LLC submitted a request for relief from Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i) for the Hope Creek Generating Station (Hope Creek). Specifically, Relief Request HC-RR-B08 proposed to incorporate reduced ultrasonic examination volume requirements for Class 1 Reactor Pressure Vessel Nozzle-to-Vessel Welds. The request for relief is for the second 10-year inservice inspection interval, which commenced on December 13, 1997.

Based on the information provided, the U.S. Nuclear Regulatory Commission (NRC) staff concludes that your proposed reduction in ultrasonic examination volume requirements, as described in Relief Request HC-RR-B08, provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes you to use the proposed alternatives pursuant to 10 CFR 50.55a(a)(3)(i) for the second 10-year interval at Hope Creek.

The NRC staff's Safety Evaluation is enclosed. If you have any questions, please contact your Project Manager, Richard Ennis, at 301-415-1420.

Sincerely,

/RA/

James W. Clifford, Chief, Section 2  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-354

Enclosure: As stated

cc w/encl: See next page

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Hope Creek Generating Station

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF HC-RR-B08

SECOND 10-YEAR INSERVICE INSPECTION INTERVAL

HOPE CREEK GENERATING STATION

PSEG NUCLEAR, LLC

DOCKET NO. 50-354

1.0 INTRODUCTION

By letter dated February 20, 2003, as supplemented by letter dated May 1, 2003, PSEG Nuclear, LLC (PSEG or the licensee) submitted a request for relief from Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i) for the Hope Creek Generating Station (Hope Creek). Specifically, Relief Request HC-RR-B08 proposed to incorporate reduced ultrasonic testing (UT) examination volume requirements for class 1 Reactor Pressure Vessel (RPV) Nozzle-to-Vessel Welds. Relief Request HC-RR-B08 applies to the second 10-year inservice inspection (ISI) interval, which commenced on December 13, 1997.

2.0 BACKGROUND

The ISI of ASME Code Class 1, 2, and 3, components is to be performed in accordance with Section XI of the ASME Code and applicable addenda as required by 10 CFR 50.55a(g), except where specific relief has been granted by the U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). As stated in 10 CFR 50.55a(a)(3)(i), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first ten-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 10-year interval, subject to the limitations and modification

Enclosure

listed therein. For Hope Creek, the applicable edition of Section XI of the ASME Code for the second 10-year ISI interval is the 1989 Edition, without Addenda.

### 3.0 EVALUATION

#### 3.1 Components for which Relief is Requested:

Relief is being requested for ASME Section XI, Class 1, RPV Nozzle-to-Vessel welds.

#### 3.2 Applicable Code Requirements from which Relief is Requested:

Pursuant to 10 CFR 50.55a(a)(3)(i), PSEG is requesting relief from ASME, Section XI, 1989 Edition, Table IWB-2500-1, Examination Category B-D, Full Penetration Welds of Nozzles in Vessels, Code Item B3.9; Figures IWB-2500-7(a) and (b), for defining the examination volume requirements for ultrasonic examination of nozzle-to-vessel welds. Specifically, the licensee is requesting relief from the  $t_s/2$  ( $t_s$  is equal to the vessel wall thickness) examination volume requirements of Figures IWB-2500-7(a) and (b).

#### 3.3 Licensee's Proposed Alternative:

PSEG proposes to use a reduced UT examination volume, which extends to one-half inch from the widest part of the weld, in lieu of the examination volume requirements of ASME Section XI Figures IWB-2500-7(a) and (b), which specify a UT examination volume extending to a distance of  $t_s/2$  from the widest part of the weld.

In addition, PSEG will perform UT examination in accordance with ASME, Section XI, 1995 Edition, 1996 Addenda, Appendix VII, Supplements 4, 6, and 7, as modified by 10 CFR 50.55a.

#### 3.4 Licensee's Basis for the Proposed Alternative:

In their February 20, 2003 submittal, the licensee provided the following basis for the proposed alternative:

PSEG Nuclear, Hope Creek is currently required to perform inservice examination of selected welds in accordance with the requirements of 10 CFR 50.55a, Plant Technical Specifications, and the 1989 American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Rules for In-Service Inspection of Nuclear Power Plant Components. The Code invokes the ( $t_s/2$ ) examination volume requirements of Figures IWB-2500-7 (a) and IWB-2500-7 (b).

The examination volume for the RPV pressure retaining nozzle-to-vessel welds extend far beyond the weld into the base metal, and is unnecessarily large. This increases the examination time significantly, and results in no net increase in safety, as the area being examined is base metal region which is not prone to inservice cracking and has been extensively examined during construction, preservice examination and during the first inservice examinations with acceptable results. Creation of flaws during plant service is unlikely due to the low stresses in the base metal away from the weld. Stresses caused by welding are concentrated at and near the weld. This relief request would reduce the

examination volume next to the widest part of the weld from one half of the vessel wall thickness to one half ( $\frac{1}{2}$ ) inch.

The reduction of the examination will reduce examination time, which translates to significant cost savings and reduce personnel radiations exposure.

The UT examination of the RPV vessel to nozzle welds will be performed as they have been in previous examinations, from the vessel shell. The examination will utilize Appendix VIII Supplements 4, 6, & 7 as modified by 10 CFR 50.55a.

By letter dated April 16, 2003, the staff requested additional information from the licensee to support the request for relief. In this letter, the staff requested that the licensee provide a diagram showing the examination volume and a list of all nozzle-to-vessel welds within the scope of this relief request. The sketch and list provided by the licensee are shown in Attachment 1 and Attachment 2, respectively.

The staff also requested that the licensee provide the technical basis to conclude that the portions of the base metal that would be excluded from UT examination by this relief request are not susceptible to service-induced degradation. In response, the licensee stated that the basis for the conclusion was derived from the Electric Power Research Institute: Technical Report 1003557 BWRVIP-108: BWR [Boiling Water Reactor] Vessel and Internals Project - Technical Basis for the Reduction of Inspection Requirements for the Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii; and GE Nuclear Energy: Hope Creek Feedwater Nozzle Fracture Mechanics Analysis Report NDEC-32480P Rev. 1, September, 2001. The licensee also stated that the first ISI 10-year examinations, conducted in accordance with the 1983 Edition of ASME Section XI, yielded no indication of service-induced degradation in the base material. The licensee further stated that nozzles RPV1-N1A, N2A, N2B, N2C, N2J, N2K, N5A, N5B, and N9A had been ultrasonically inspected during the second 10-year ISI interval, yielding no indication of service-induced degradation in the base material.

Additionally, the staff requested that the licensee provide information related to repaired areas (fabrication or inservice) that extend beyond the cross-sectional area to be examined. The licensee provided the staff with PSEG drawings PN1-B11-A001-0151 sheets 1 and 2, and stated that a review of the drawings determined that all repairs completed were encapsulated within the existing nozzle-to-vessel weld.

### 3.5 Staff Evaluation:

PSEG has requested relief from the UT Examination volume requirements specified in Table IWB-2500-1, Examination Category B-D, Code Item B3.90, Figures IWB-2500-7(a) and (b), pertaining to UT Examination of Full penetration Nozzles in Vessels. PSEG proposed to use a reduced examination volume, extending to one-half inch from each side of the widest part of the nozzle-to-vessel weld in lieu of an examination volume extending to a distance equal to one-half the through-wall thickness from each side of the widest part of the nozzle-to-vessel weld, as required by Figures IWB-2500-7(a) and (b).

At the request of the staff, PSEG provided a supplemental sketch showing the specific configuration of the nozzle-to-vessel weld and the revised examination volume, as well as a listing of all nozzle-to-vessel welds included within the scope of this relief request. The specific

weld configuration and revised examination volume are depicted as region A-B-C-D-E-F-G-H within Figure 2 of ASME Code Case N-613-1 (Attachment 1). All nozzle-to-vessel welds included within the scope of this relief request are of the type depicted in Figure 2 of Code Case N-613-1. The revised examination volume depicted in this sketch extends to one-half inch from each side of the widest part of the nozzle-to-vessel weld and is, therefore, consistent with the licensee's request for the reduced UT examination volume. All other aspects of the UT examination volumes for RPV nozzle-to-vessel welds remain unchanged by the licensee's request.

The acceptability of the reduced UT examination volume is based on prior full volumetric examinations of the welds and base metal, as well as the internal stress distribution near the weld. Prior full volumetric examinations of the nozzle-to-vessel welds included within the scope of this relief request cover the full volume of base metal, extending to a distance equal to one-half the through wall thickness from each side of the widest part of the nozzle-to-vessel weld, as required by the Code. This base metal region included in the original ASME Code volume was extensively examined during construction, preservice inspection, and prior ISIs. These examinations all show the ASME Code volume to be free of unacceptable flaws. The creation of flaws during plant service in the volume excluded from the proposed reduced examination volume is unlikely because of the low stress in the base metal away from the weld. The stresses caused by welding are concentrated at, or near, the weld. Cracks, should they initiate, occur in the highly stressed area of the weld. These areas are within the volume included in the reduced examination volume proposed by PSEG. The prior full volume examinations of the base metal provide the appropriate assurance that these areas are free of unacceptable flaws.

PSEG will perform the UT examination of the specified nozzle-to-vessel welds from the outer diameter of the vessel welds using manual ultrasonic methods. This will allow for the extremities of the nozzle-to-vessel welds to be precisely located, thereby assuring complete coverage of the modified examination volume on each side of the weld crown. PSEG has documented the precise locations of repaired areas for all RPV nozzle-to-vessel welds at Hope Creek. Based on a review of the documentation, and associated drawings of repaired areas for all RPV nozzle-to-vessel welds, PSEG determined that all weld repairs are encapsulated within the existing nozzle-to-vessel welds. The inclusion of repaired areas for all RPV nozzle-to-vessel welds within the reduced examination volume will provide adequate coverage of these areas of higher stress.

PSEG has indicated that the proposed UT examination of nozzle-to-vessel welds will be performed with personnel and procedures qualified according to the requirements of Supplements 4, 6, and 7 of Appendix VIII, ASME Section XI, 1995 Edition, 1996 Addenda, in accordance with 10 CFR 50.55a, and with the modifications specified therein. These requirements will be followed, in lieu of the requirements of their ISI Code of Record. The ISI Code of Record requires the use of prescriptive criteria for qualifying UT techniques. The staff has determined that the use of prescriptive criteria for qualifying UT techniques may be less effective than the use of performance-based criteria for detecting and sizing flaws in reactor vessels. This determination was made in the September 22, 1999, rulemaking (64 FR 51370) that revised 10 CFR 50.55a and mandated accelerated implementation of Appendix VIII to Section XI of the ASME Code. The rule requires that the examination of nozzle-to-vessel welds

utilize performance-based UT techniques that are qualified according to the criteria in Section XI, Appendix VIII. This rule has been incorporated into the 2003 Edition of 10 CFR 50.55a. The licensee has committed to meeting these requirements.

Based on the above discussion, the staff finds that the areas to be excluded from UT examination by the relief request have previously been found to be free of unacceptable flaws by examinations performed during inservice inspection and fabrication. The staff further finds that the initiation of flaws in these regions, subsequent to the performance of said examinations, is highly unlikely due to the lower weld-induced stresses in these regions. Therefore, the staff finds that the proposed alternative to reduce the UT examination volume to one-half inch from the widest part of the nozzle-to-vessel weld on each side of the weld crown will provide an acceptable level of quality and safety.

#### 4.0 CONCLUSION

Based on its review, the NRC staff has determined that the proposed Relief Request HC-RR-B08, submitted on February 20, 2003, as supplemented by letter dated May 1, 2003, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the remainder of the second 10-year ISI interval at Hope Creek. The NRC staff's authorization is limited to those components described in Section 3.1 and enumerated in Attachment 2.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the authorized Nuclear Inservice Inspector.

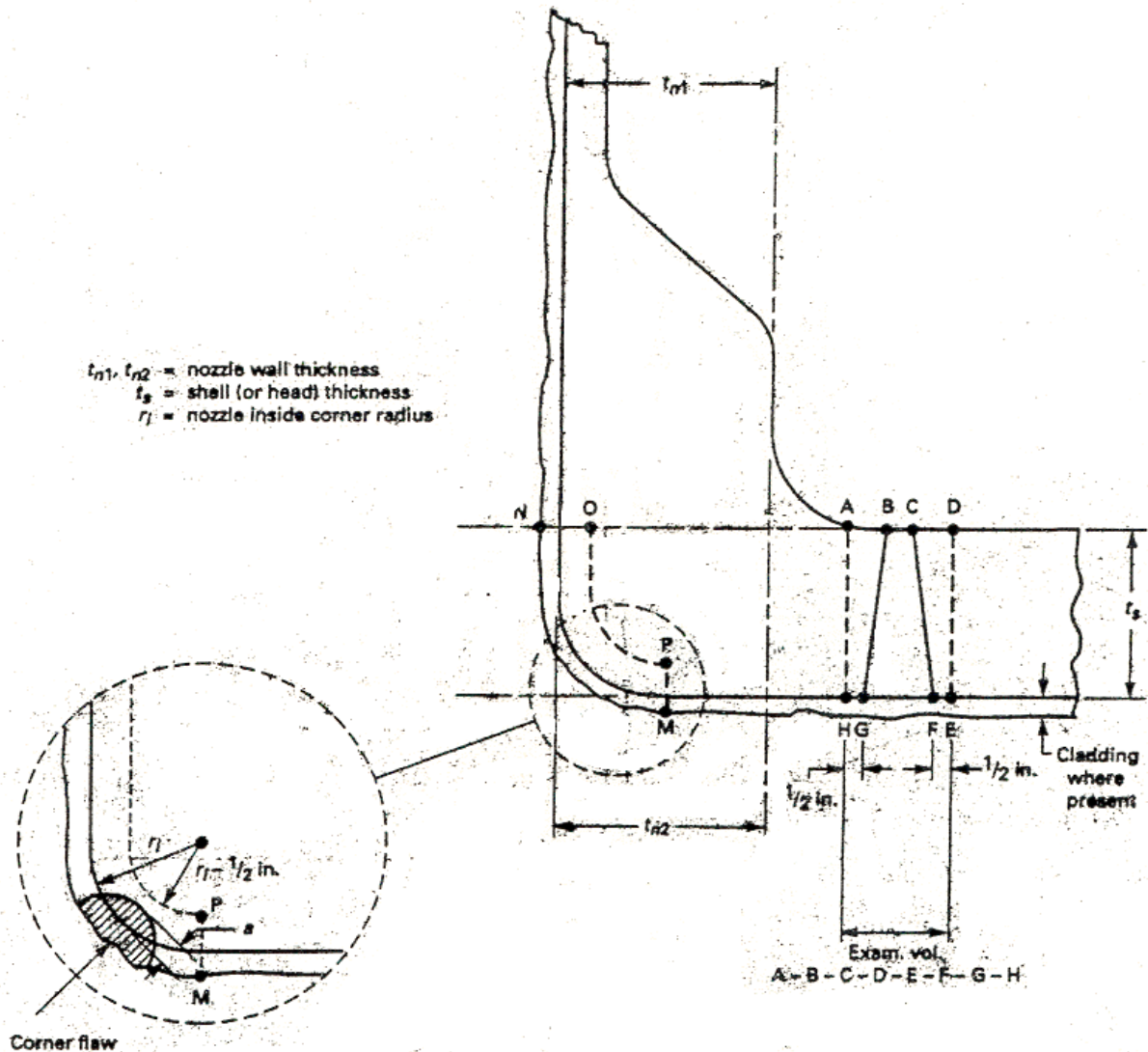
Principal Contributor: C. Sydnor

Date: August 26, 2003



# **ATTACHMENT 1** **ASME Code Case N-613-1 Figure 2**

## CASES OF ASME BOILER AND PRESSURE VESSEL CODE



### **EXAMINATION REGION [Note (1)]**

Shell (or head) adjoining region  
 Attachment weld region  
 Nozzle cylinder region  
 Nozzle inside corner region

### **EXAMINATION VOLUME [Note (2)]**

C-D-E-F  
 B-C-F-G  
 A-B-G-H  
 M-N-O-P

### **NOTES:**

- (1) Examination regions are identified for the purpose of differentiating the acceptance standards in IWB-3512.
- (2) Examination volumes may be determined either by direct measurements on the component or by measurements based on design drawings.

**FIG. 2 NOZZLE IN SHELL OR HEAD**

**ATTACHMENT 2****Hope Creek Nozzle-to-Vessel Welds Within Scope of Request**

Summary No.	Component ID	Description	Nozzle Configuration	Full Exam Coverage Exam Previously Completed
100185	PRV1-N1A	Loop A Recirculation System Outlet at 0 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100190	RPV1-N1B	Loop B Recirculation System Outlet at 180 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100195	RPV1-N1A	Recirculation System Inlet At 30 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100200	RPV1-N2B	Recirculation System Inlet At 60 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100205	RPV1-N2C	Recirculation System Inlet At 90 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100210	RPV1-N2D	Recirculation System Inlet At 120 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100215	RPV1-N2E	Recirculation System Inlet At 150 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100220	RPV1-N2F	Recirculation System Inlet At 210 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100225	RPV1-N2G	Recirculation System Inlet At 240 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100230	RPV1-N2H	Recirculation System Inlet At 270 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100235	RPV1-N2J	Recirculation System Inlet At 300 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100240	RPV1-N2K	Recirculation System Inlet At 330 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100245	RPV1-N3A	Main Steam Outlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100250	RPV1-N3B	Main Steam Outlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100255	RPV1-N3C	Main Steam Outlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100260	RPV1-N3D	Main Steam Outlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100265	RPV1-N4A	Feedwater Inlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100270	RPV1-N4B	Feedwater Inlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100275	RPV1-N4C	Feedwater Inlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes

100280	RPV1-N4D	Feedwater Inlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100285	RPV1-N4E	Feedwater Inlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100290	RPV1-N4F	Feedwater Inlet Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100295	RPV1-N5A	Core Spray Inlet at 120 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100300	RPV1-N5B	Core Spray Inlet at 240 Deg Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100404	RPV1-N6A	Head Spray Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100405	RPV1-N6B	Spare Head Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100406	RPV1-N7	Head Vent Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100320	RPV1-N8A	Jet Instrumentation Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100325	RPV1-N8B	Jet Instrumentation Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100330	RPV1-N9A	Control Rod Drive (CRD) Hydraulic Return Nozzle to Vessel Weld	Code Case N-613-1 Figure 2	Yes
100400	RPV1-N7A	Low Pressure Core Injection (LPCI) Nozzle to Vessel Weld at 45 Deg	Code Case N-613-1 Figure 2	Yes
100401	RPV1-N7B	Low Pressure Core Injection (LPCI) Nozzle to Vessel Weld at 135 Deg	Code Case N-613-1 Figure 2	Yes
100402	RPV1-N7C	Low Pressure Core Injection (LPCI) Nozzle to Vessel Weld at 225 Deg	Code Case N-613-1 Figure 2	Yes
100403	RPV1-N7D	Low Pressure Core Injection (LPCI) Nozzle to Vessel Weld at 315 Deg	Code Case N-613-1 Figure 2	Yes